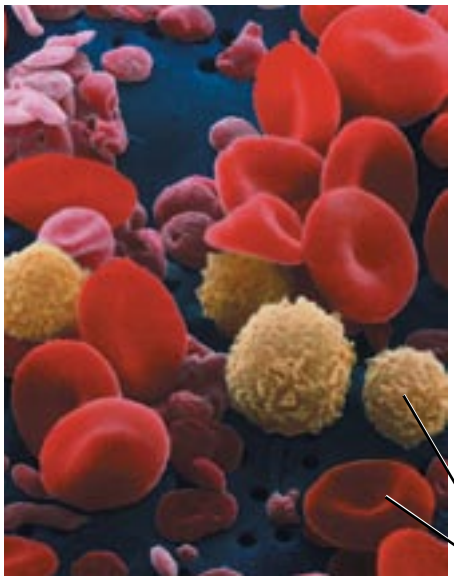
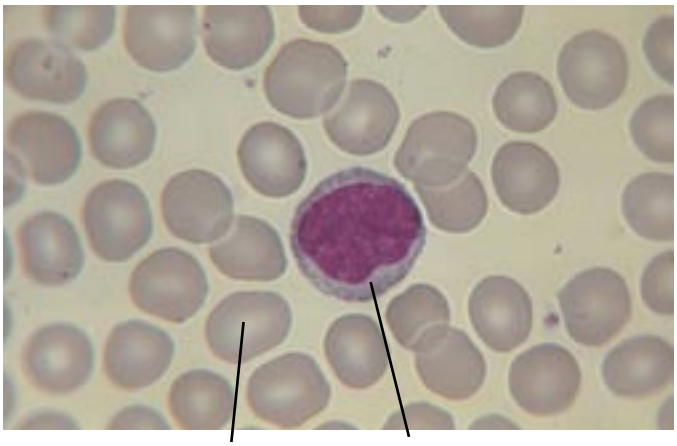
46 Disease Fighters

What does your body do to protect itself from invading microbes? Even before an organism can enter your body, your skin provides a protective barrier. But foreign substances can still enter through cuts or natural body openings, such as your mouth or your nose. Tears, saliva, and mucus help to remove some invaders at these sites. But when foreign substances cross these barriers, your **immune** (ih-MYOON) **system** comes to the rescue.

Your immune system has the amazing ability to distinguish between the substances of your own body and foreign substances, such as bacteria and viruses. A healthy immune system can then mount a defense against these invaders. Several kinds of cells, particularly white blood cells, are responsible for this immune response. The pictures here show normal human blood cells. Note that the red blood cells are the most common. Also note the detail of the white blood cells. They increase in number when the body is under attack from a foreign substance.





The photograph on the left was taken through a scanning electron microscope, while the photograph on the right was taken through a light microscope .

Immune responses of the human body are not always helpful. Any new material in the body, including blood and organs, can trigger an immune response. It is this reaction of the immune system that makes organ transplants and blood transfusions difficult. If the blood type of the blood donor is not compatible with that of the person receiving the blood, the transfused blood cells are seen as foreign by the immune system and they clump together. These clumps can create blockages in blood vessels and cause death. That is why it's important to know which types of blood can be donated safely to people with each of the four human **blood types: A, B, AB, and O.** You will simulate what happens to a person's blood when blood from a donor is added.

CHALLENGE **How does your blood help fight infectious diseases?**

MATERIALS

Part A: Blood Type and the Immune Response

For each group of four students

- **1 bottle of Donated Blood (Type A)**
- **1 bottle of Donated Blood (Type B)**
- **1 bottle of Donated Blood (Type O)**
- **1 bottle of Sasha's Blood Serum (Type A)**
- **1 bottle of Fong's Blood Serum (Type B)**
- **1 bottle of Jordan's Blood Serum (Type AB)**

For each pair of students

- **1 SEPUP tray**

Part B: Blood Cells

For each pair of students

- **1 slide of normal human blood**
- **1 microscope**

For each student

- **Student Sheet 45.1, "Anticipation Guide: Diseases and Prevention," from Activity 45**

PROCEDURE

Within each group of four students, one pair begins with Part A and the other pair begins with Part B. When both pairs have completed their parts, they can switch roles.

Part A: Blood Type and the Immune Response

Blood Emergency

Three patients needing blood transfusions have arrived at the local hospital. This is the chart showing their blood types. In order to supply the blood, the hospital staff has asked the community to help. Several people respond by donating blood. The hospital receives blood donations of types A, B, and O, but these blood types might not be compatible with each patient.

Patient	Blood Type
Sasha	A
Fong	B
Jordan	AB

Does the hospital have enough of the right type of blood for each patient? Find out by testing samples of each blood type.

1. Collect the three blood samples and the three serum samples.

   Note: *Serum* is blood that has had the red blood cells removed. In blood transfusions, the donor's blood must be compatible with the patient's serum.

2. Design a data table to record your experimental results. You will test each of the three donated blood types with serum from each of the three patients.

3. Place two drops of Sasha's Blood Serum in Cups 1–3 of your SEPUP tray.

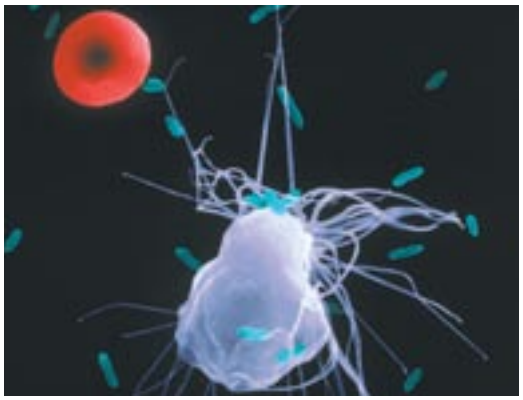
4. Add two drops of Donated Blood Type A to Cup 1. Does there appear to be clumping? Record the results in your data table.

5. Test Sasha's Blood Serum with the remaining donated blood samples. Record the results in your data table.

6. Use Cups 4–9 to test the samples from the other two patients, Fong and Jordan. Record the results in your data table.

Part B: Blood Cells

7. You and your partner should receive a microscope slide of normal human blood.



This high power scanning electron microscope photograph has been colorized. A red blood cell is near the top of the picture. A white blood cell (colored purple) is attacking bacteria (colored blue-green).

8. Be sure that your microscope is set on the lowest power (shortest objective) before placing your slide onto the microscope stage. Center the slide so that the specimen is directly over the light opening and adjust the microscope settings as necessary.

   Hint: To check that you are focused on the material that is on the slide, move the slide slightly while you look through the eyepiece—the material that you are focused on should move at the same time you move the slide.

9. Begin by observing the slide on low power (usually the 4x objective). Scan the slide and focus on a section that shows more than one kind of cell.

   Hint: Remember that stains are often used to make structures on a slide more visible. Look carefully for a light pink smear with a dark purple blob. If material on the slide is too light to see, reduce the amount of light on the slide: do this by slightly closing the diaphragm under the stage.

10. Without moving the slide (which can be secured with stage clips), switch to medium power (usually 10x). Adjust the microscope settings as necessary.

11. Without moving the slide, switch to high power (usually the 40x objective). *Be careful not to smash the objective against the slide!* Adjust the microscope settings as necessary.

    Hint: If material on the slide is too dark to see, increase the amount of light on the slide: do this by slightly opening the diaphragm under the stage.

12. In your science notebook draw the two different kinds of cells that you see. Remember to use the "Rules for Microscopy Drawing" that you developed in Activity 36, "Looking for Signs of Micro-life." Describe the cells. Be sure to include which type of cell is most common, the shape of each cell, the relative size, and any cell structures you are able to identify in either cell.

ANALYSIS

Part A: Blood Type and the Immune Response

1. Each patient required one pint of blood. The hospital received one pint each of type A, B, and O blood. Explain whether the hospital had enough of the right type of blood for each patient.

2. What prevents your body from accepting transfusions of certain types of blood?

Part B: Blood Cells

3. Think back to all the work that you have been doing on cells. Compare and contrast different types of cells by copying and completing the table below.

Cell Type	Cell shape	Cell membrane?	Cyptoplasm?	Nucleus?
Bacteria				
Protist				
Plant (onion)				
Animal cheek				
Animal: red blood cell				
Animal: white blood cell				

4. Fill in the "After" column for Statements 5–7 only on Sheet 45.1, "Anticipation Guide: Diseases and Prevention." Did your thinking change?

5. In what ways does your body prevent you from catching an infectious disease?

EXTENSION

For links to more information on the blood and diseases of the blood, go the *Issues and Life Science* page of the SEPUP website.